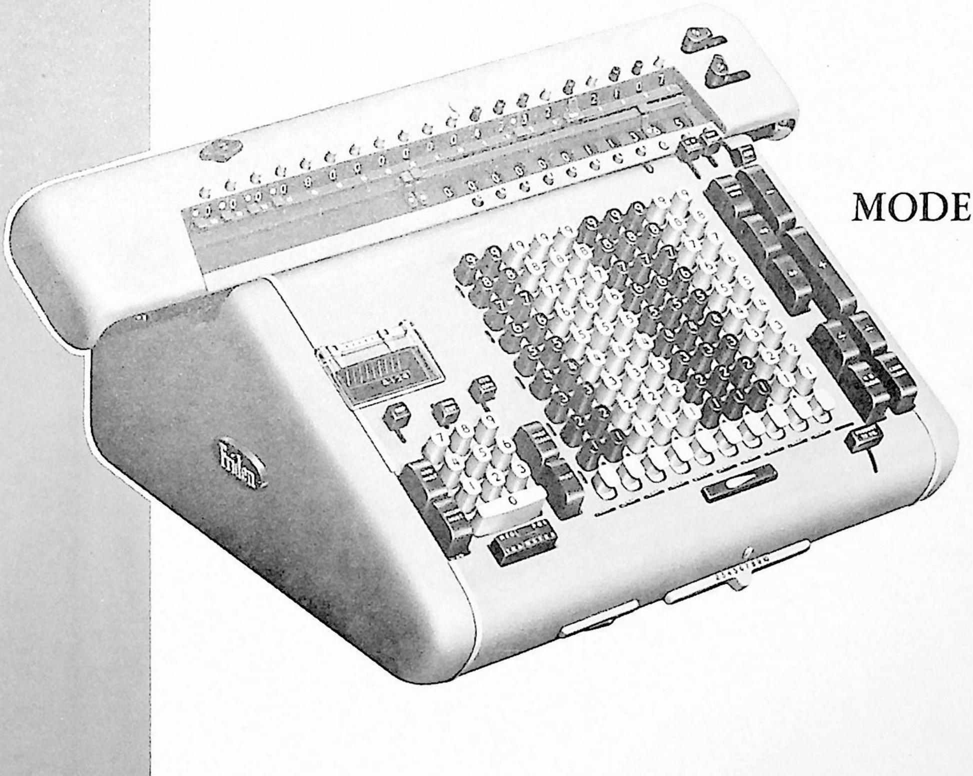
Friden CALCULATING MACHINE

ADJUSTMENT MANUAL



MODEL SBT

Friden, Inc.

SAN LEANDRO, CALIFORNIA

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PREFACE

This manual outlines the adjustments that are special to the Model SBT Calculator. The adjustments that are common to the basic machine are found in the Calculating Machine Adjustment Manual.

The adjustment clearances as given are believed to be the best for the proper operation of the Back Transfer mechanism and are used by the Calculator Assembly Department.

Because the main purpose of adjustments is to place a machine in proper operating order, please keep in mind that variations of tolerance between parts often necessitate the changing of a prescribed clearance. The changing of a clearance may be done when the machine is manufactured or it may be done by the service technician. However, DO NOT change adjustments without good cause.

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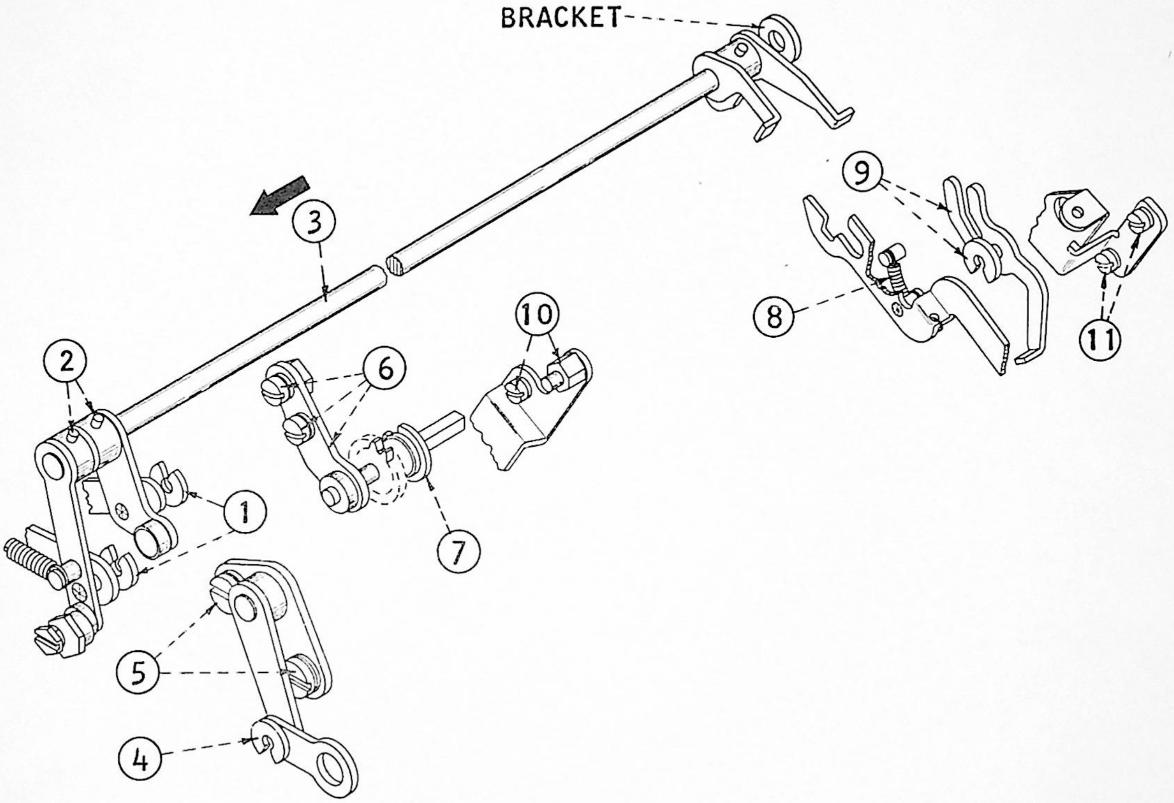
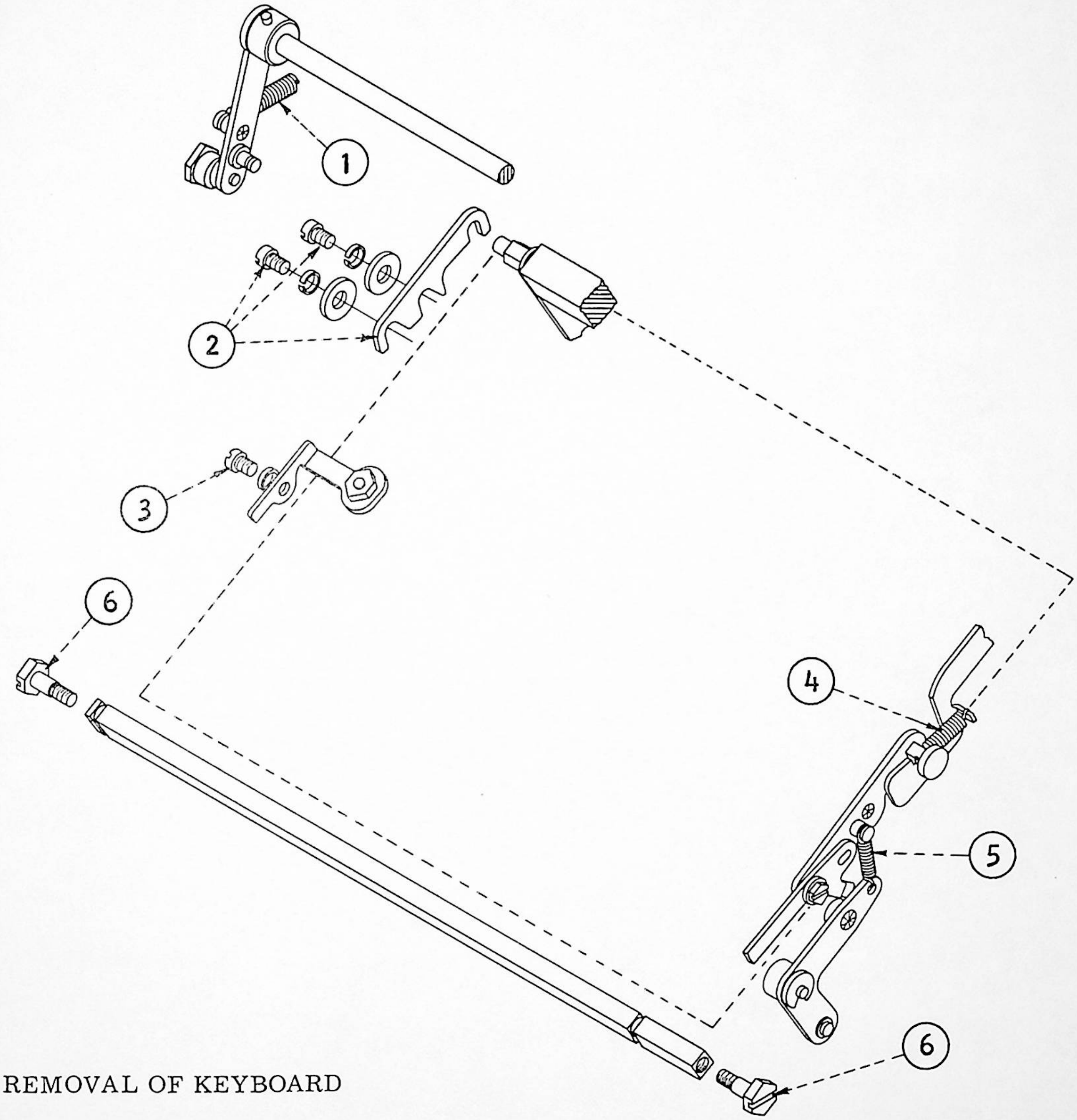


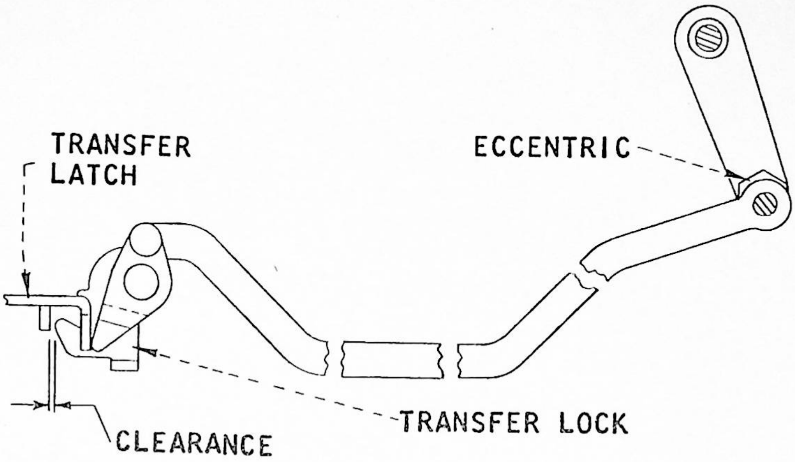
REMOVAL OF PROGRAM UNIT

1. Remove clips from parts on starting shaft.
2. Remove pins from parts on left end of starting shaft.
3. Pull shaft to left so right end is out of bracket, then pull shaft to right for removal.
4. Remove clip from restore shaft link.
5. Remove screws from restore shaft bracket.
6. Remove screws from bearing bracket. Remove bracket.
7. Remove clip from feed out gear shaft for feed out gear.
8. Unhook spring of clear link from stud.
9. Remove clip on add release block lever. Remove lever.
10. Remove hex stud and lower screw from left end of unit.
11. Remove screws from right end of unit.
12. Remove unit.

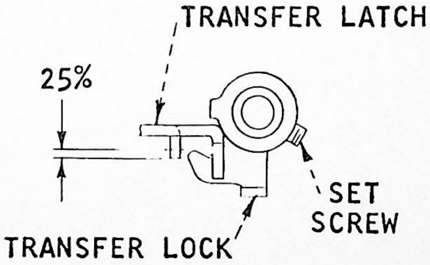


REMOVAL OF KEYBOARD

1. Remove starting shaft spring.
2. Loosen screws, remove rear clamp.
3. Remove screw. (Early models only)
4. Unhook rear of spring.
5. Unhook top of spring.
6. Remove screws.
7. Lift out keyboard.



ADJ. 1 - TRANSFER LATCH: In home position there is to be enough clearance between the transfer latch and the transfer lock so the transfer lock can be disengaged and engaged without contacting the transfer latch. A wide clearance will cause too much movement of the transfer lock during standard division, causing a selecting arm to be positioned. Adjust at the eccentric.



ADJ. 2 - TRANSFER LOCK: In home position, the transfer lock is to be engaged with the transfer latch approximately 25%. Adjust by loosening the set screw and rotating the transfer lock. The setting is to insure that the transfer latch does not disengage when the transfer keys are tapped while the machine is in standard division.

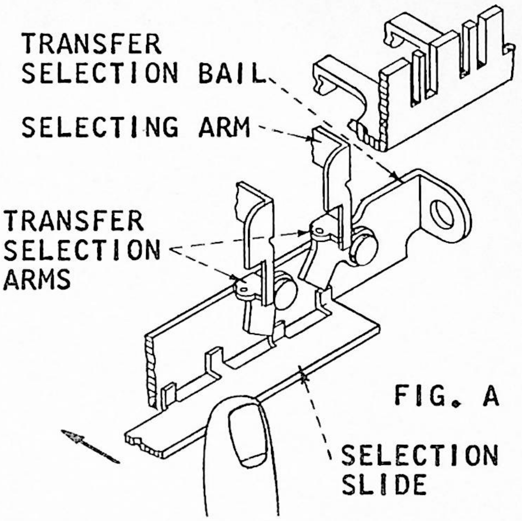


FIG. A

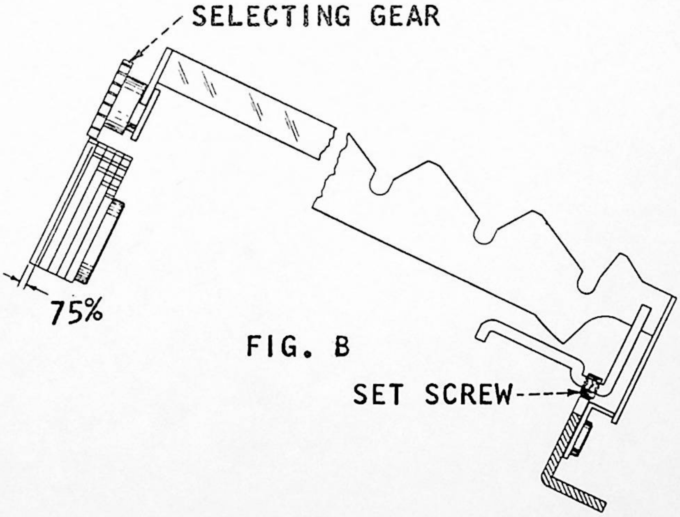
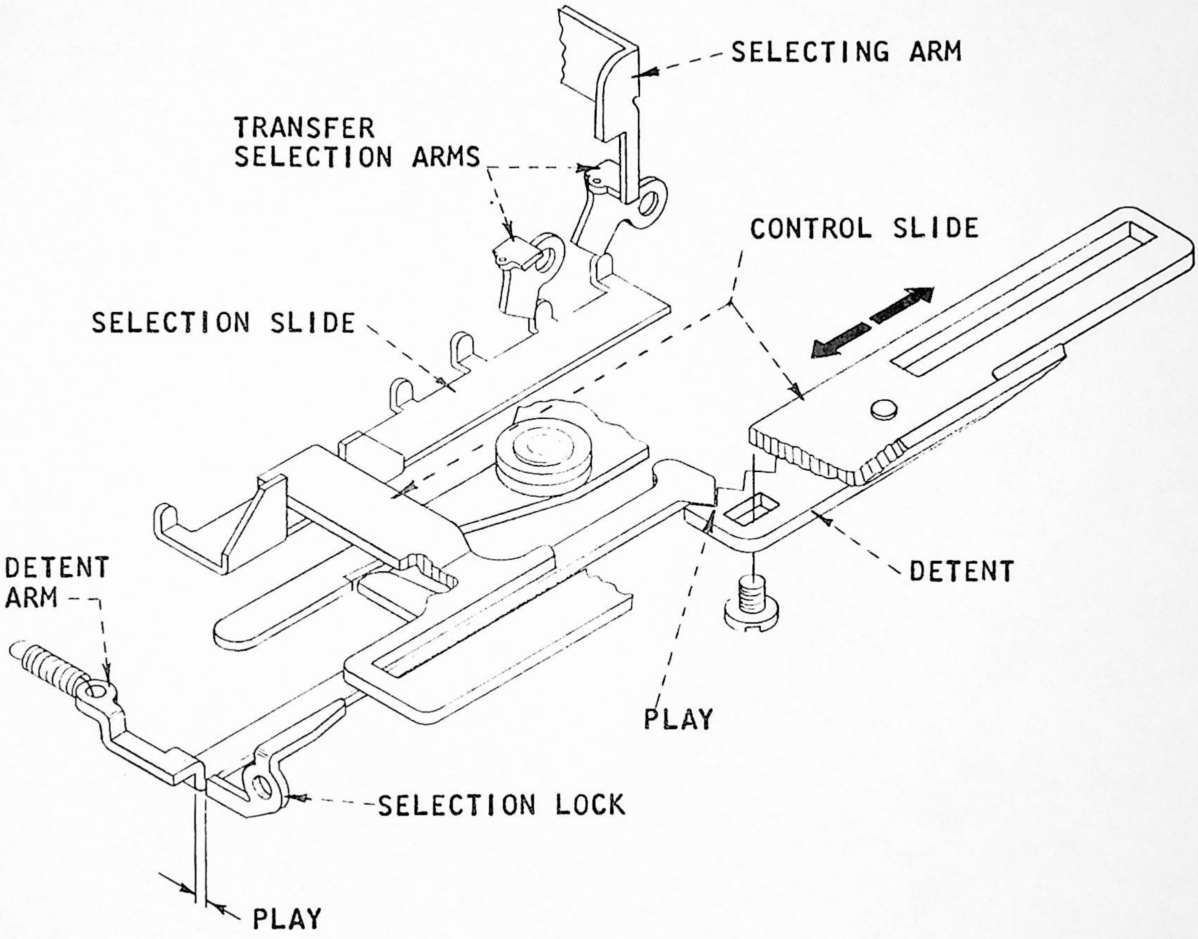
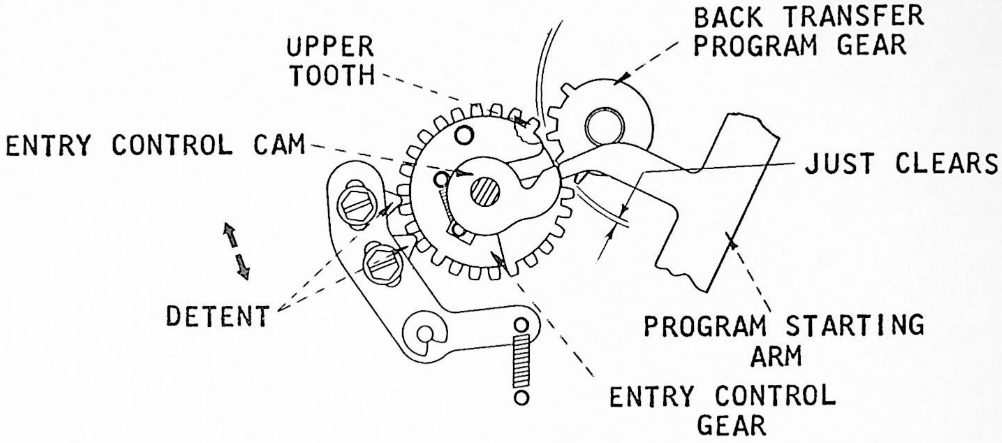


FIG. B

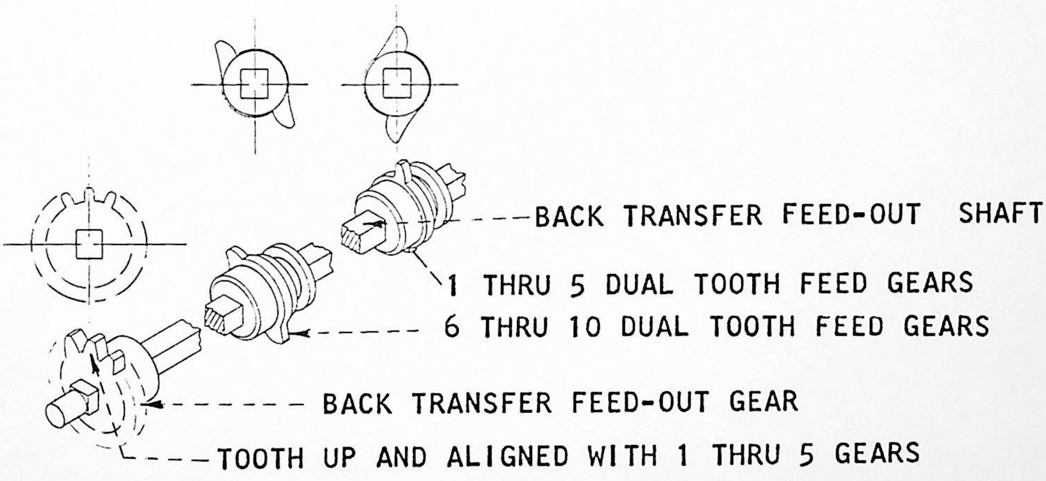
ADJ. 3 - TRANSFER SELECTION BAIL STOP: This adjustment is given here because of ease in seeing the gears while the program unit is out. Position the selection slide Fig A, so the right position transfer selection arm is behind its standard selecting arm. Rock the transfer selection bail so the selecting arm is pulled forward. Adjust the set screw, Fig B, so the selecting gear has 75% engagement with the No. 1 segment tooth of the actuator. To get the engagement of the other selecting gears, position each transfer selection arm and form the tail of each standard selecting arm. The neutral clearance of the selecting gears can be checked while the unit is out.



ADJ. 4 - POSITIONING OF TRANSFER SELECTION SLIDE: Each tooth of the selection slide is to have a full engagement with its transfer selection arm to position the arm behind the selecting arm. The teeth to the left and right are not to position their transfer selection arms. Loosen the detent and move the control slide. To make sure the control slide is positioning the proper column transfer selection arm, move the slide to the extreme right. The detent arm is to be in the left detent notch and the right transfer selection arm is to be positioned behind the second column selecting arm. The detent arm is to position fully in each detent notch with a small amount of play between the selection lock and the detent arm point. Form detent arm.



ADJ. 5 - TIMING OF ENTRY CONTROL GEAR: Time the entry control gear so the entry control cam is positioned as shown with the program starting arm. Adjust the detent to hold the entry control gear so the wide tooth of the back transfer program gear just clears the entry control gear tooth as shown and does not contact the entry control gear upper tooth. Test by releasing the clutch and cycling the drive shaft. Manually engage the floating tooth and cycle the drive shaft. The entry control gear is to turn two teeth and detent properly.


BACK TRANSFER FEED-OUT SHAFT
1 THRU 5 DUAL TOOTH FEED GEARS
6 THRU 10 DUAL TOOTH FEED GEARS
BACK TRANSFER FEED-OUT GEAR
TOOTH UP AND ALIGNED WITH 1 THRU 5 GEARS

ADJ. 6 - UNIT GEAR TIMING: (1) From right to left the first through fifth dual tooth feed gears are different from the sixth through tenth gears. Install the gears on the back transfer feed-out shaft so the first through fifth gears have a tooth to flat of the shaft and the sixth through tenth gears have a tooth to corner of the shaft as shown. (2) Before installing the program unit, slip the back transfer feed-out gear on the shaft so a tooth is to the flat of the shaft and in line with the tooth of the first thru fifth gears. To prevent the back transfer feed-out gear from slipping off while installing the unit, install snap washer to left of gear.

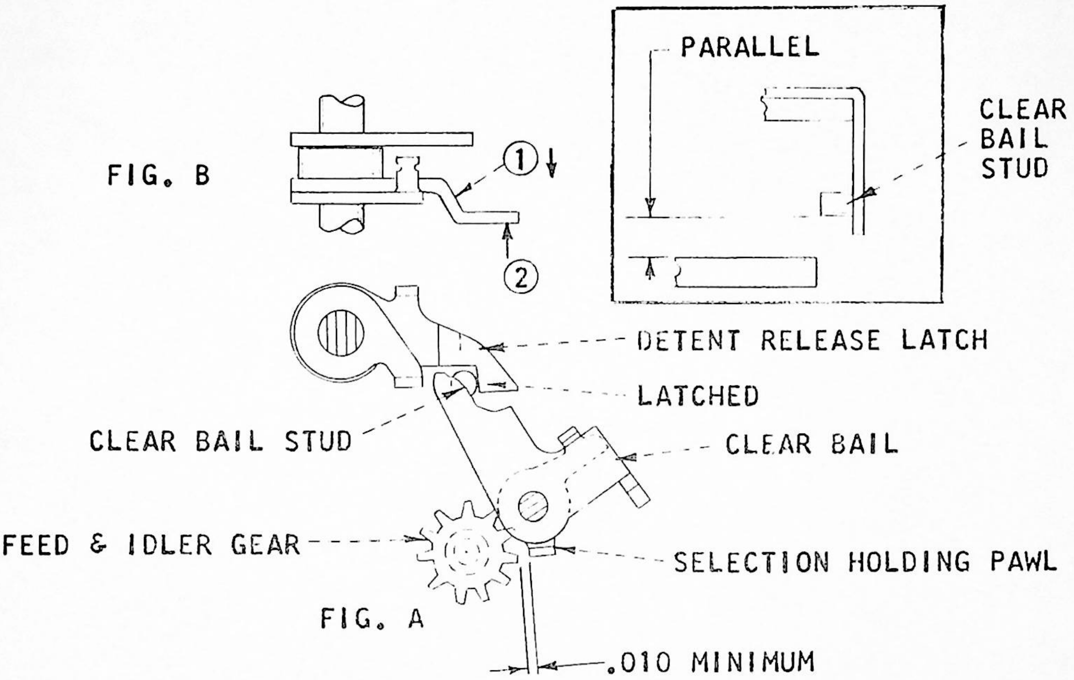
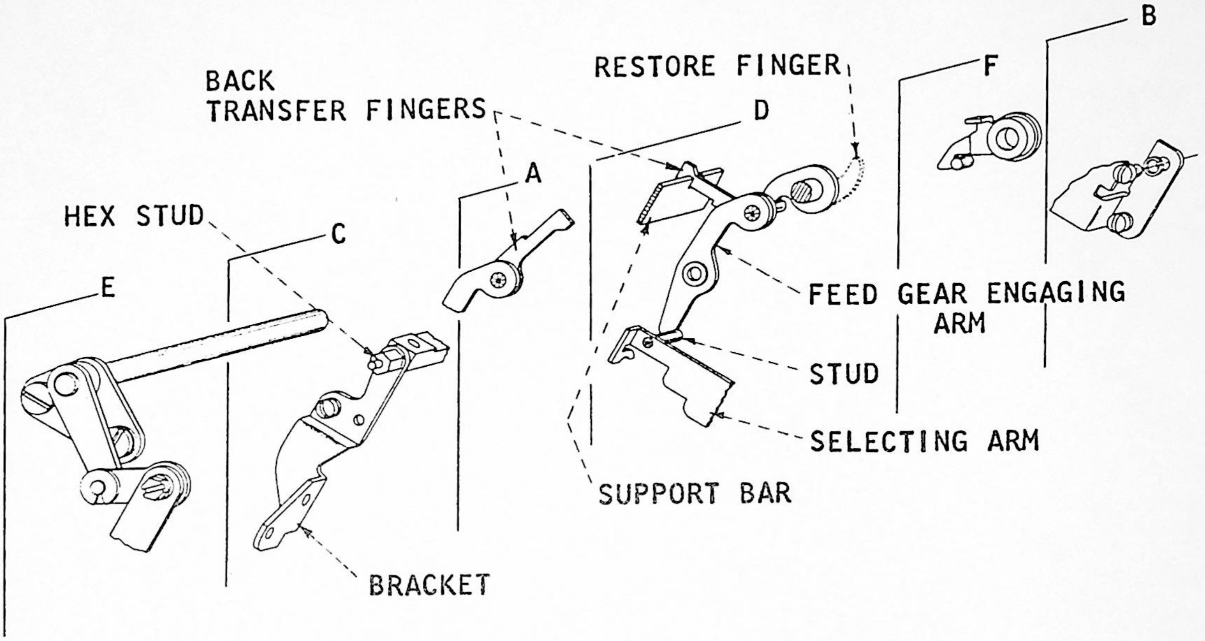


FIG. B

FIG. A

ADJ. 7 - SELECTION HOLDING PAWL CLEARANCE: Fig A. While the program unit is out, check for a minimum of .010 clearance between the selection holding pawls and the feed and idler gears when the clear bail is latched by the detent release latch. The clearance should be satisfacory on a unit that has been in a machine. When installing a new unit, the clearance may need setting. Have the clear bail stud parallel to the unit frame, inset. To obtain clearance, shorten the detent release latch, Fig B, by forming at the offset. (1) to the right, (2) then form the latch end to the left to straighten.

The clearance is to prevent the feed-out and idler gear from catching on the holding pawl when the auxiliary slides restore.



ADJ. 8A - INSTALLATION OF PROGRAM UNIT:

Before installing the unit, test all selecting arms and auxiliary slides for being free and straight. Pull them down and restore slowly.

Installation of unit. (Follow step by step with use of composite sketch).

1. Flip all back transfer fingers forward. (Section A)
2. Right end of unit to go in first. (Section B)
3. Left end of unit next by forcing the bracket slightly to the left. (Section C)
4. Position the right end to align the top hole to the frame hole. Insert the screw and lockwasher. Do not tighten. (Section B)
5. Flip back transfer fingers into slots of support bar, (Section D). Rotate the restore shaft to position the restore fingers up and forward, (Dotted lines, Section D). Prop up front of machine.
6. The lower end of the feed gear engaging arms are to be positioned to the rear of the studs on the selecting arms. (Section D). From right to left, push forward on back transfer fingers and work the top of the unit rearward and down so the lower end moves forward. (A shaft held across the top of all feed gear engaging arm so that all arms may be pulled forward at the same time may assist in positioning the lower ends.) When feed gear engaging arms are to rear of studs, hold the unit with one hand, rotate the restore shaft with the other hand so the restore fingers (solid line, section D) pull the lower end of the feed gear engaging arms away from the selecting arm studs. Engage the left arm of the restore shaft with the restore shaft link (section E). Have detent release latch engaged with the clear bail stud, (section F).
7. Insert the hex stud at top left of unit, (section C) leave loose. Insert bottom left and right screws and lockwashers. Leave loose. (Continue to Adj. 8B).

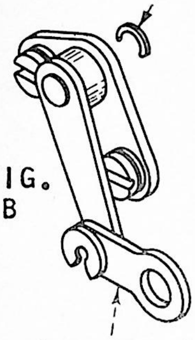


FIG. B

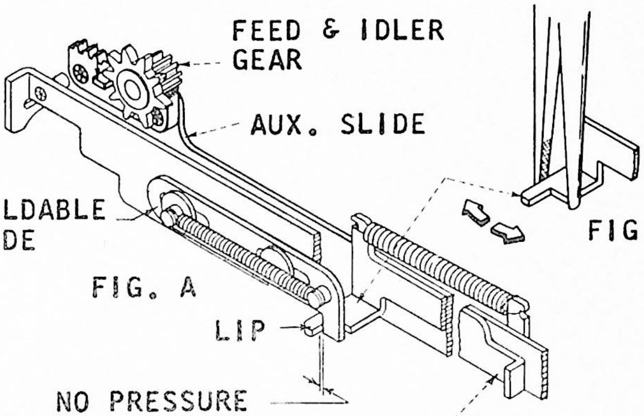


FIG. A

FIG. C

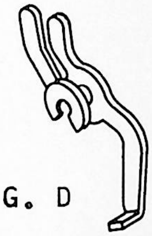


FIG. D

ADJ. 8B - INSTALLATION OF PROGRAM UNIT - SELECTION POSITIONING AND AUXILIARY SLIDE ALIGNMENT.

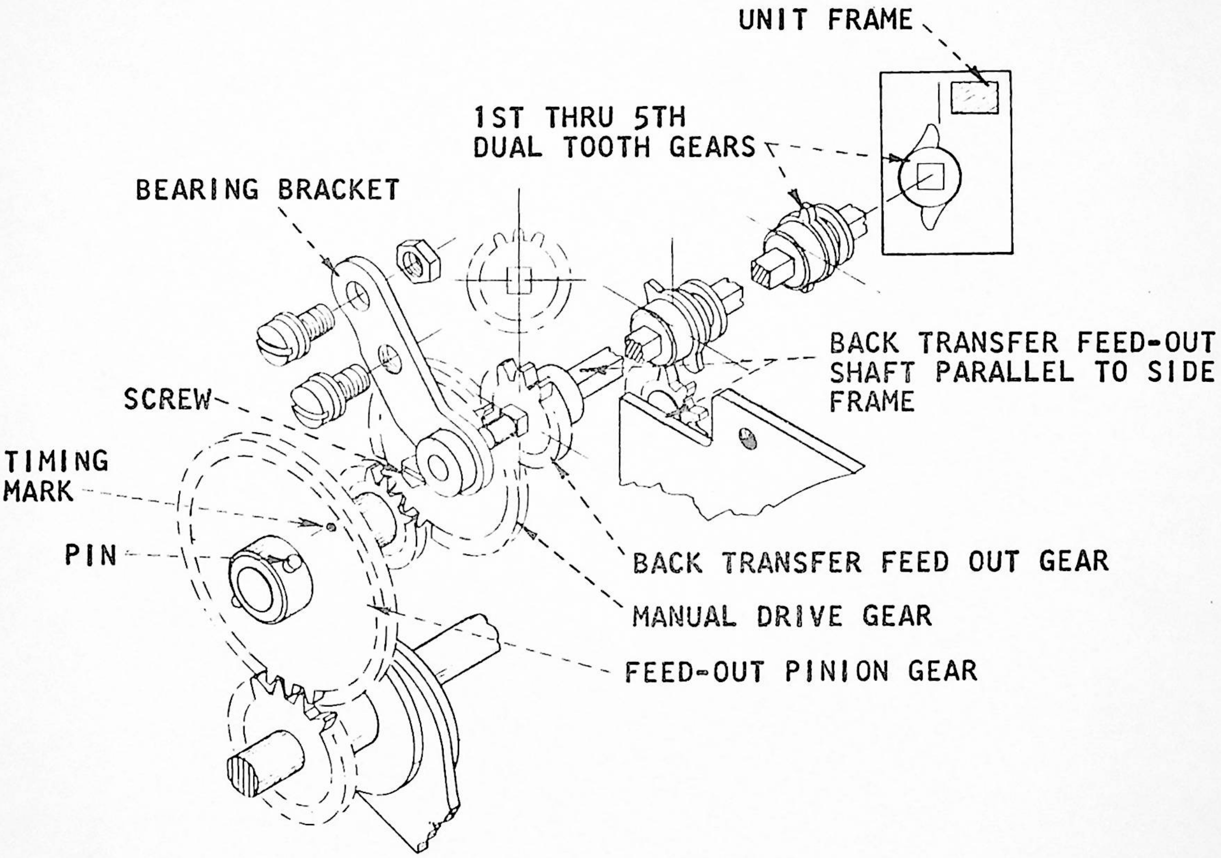
8. Move top of unit to the rear and the bottom forward to bring the lips, Fig. A, of selection positioning slides from .003 to no pressure to yieldable slides on selecting arms. Tighten screws and hex stud of unit. (Temporary positioning)

9. Unhook restore shaft link. Install screws, spacers and lockwashers into restore shaft bracket to line up shaft so it is free. Hook up link. Install metal clip on restore shaft.

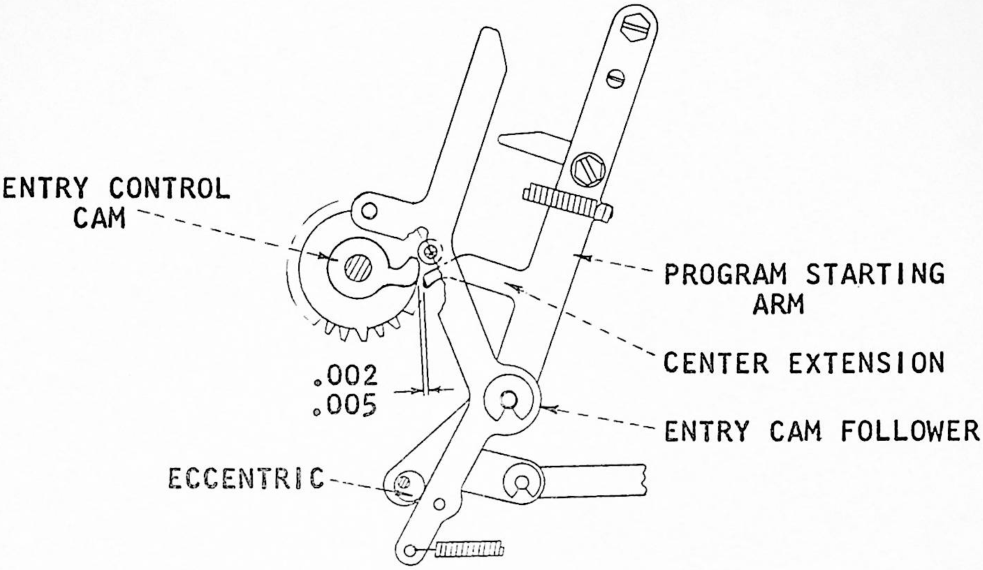
10. Have clear bail stud latched by detent release latch. Test for free action of auxiliary slides by pulling forward and restoring slowly without side pressure. When an auxiliary slide binds or restores roughly, loosen unit and shift it around until slides are free. Retain the clearance in Par. 8. Tighten screws.

11. When auxiliary slides are free, make final setting of selection positioning slide lips to selecting arm yieldable slides. Form lips as shown, Fig. C.

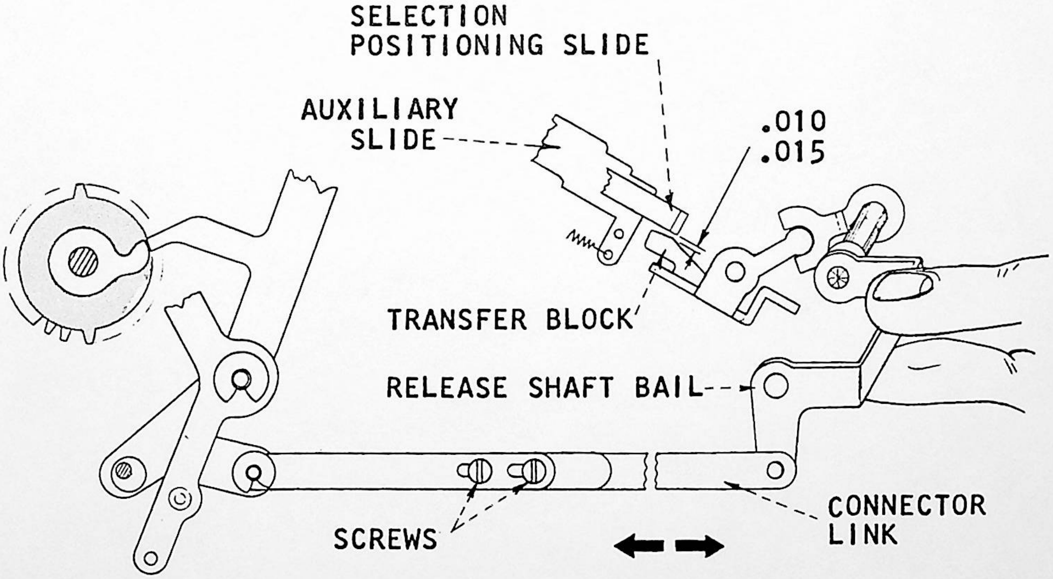
12. Install add release block lever, Fig. D.



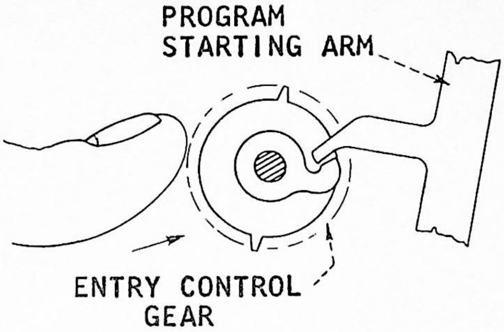
ADJ. 8C - TIMING OF BACK TRANSFER FEED OUT SHAFT: When the drive shaft is in home position, the pin of the feed-out pinion gear or the timing mark is to align to the approximate center of the screw of the manual drive gear. Position the back transfer feed-out shaft so it is parallel to the side frame and the first thru fifth dual tooth feed gears are parallel to the unit frame as shown. Mesh the back transfer feed-out gear with the manual drive gear. Install the snap washer. Install and set the bearing bracket and screws so the feed-out gear does not bind with the manual drive gear.

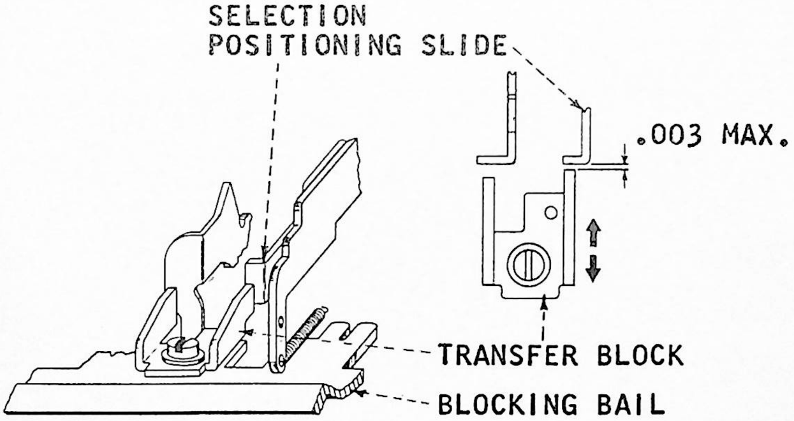


ADJ. 9A - PROGRAM STARTING ARM ECCENTRIC: Manually position the floating tooth, release the clutch and cycle the drive shaft until the entry control cam is restoring the program starting arm through the roller. When the entry control cam comes closest to the end of the center extension, adjust the eccentric to give .002 to .005 clearance. This is to prevent wear of the two parts.

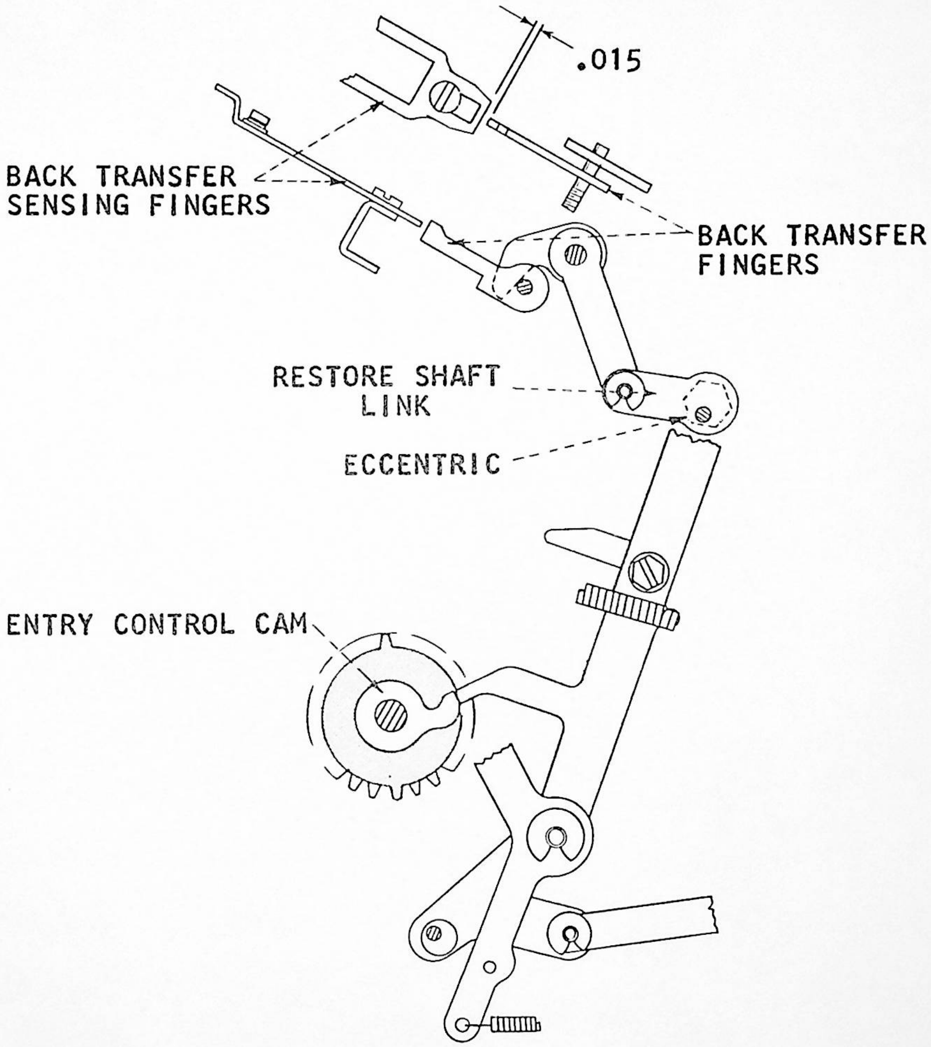


ADJ. 9B - TRANSFER BLOCK - HOME POSITION: Have the machine in home position and the keyboard out. The transfer blocks are to clear the selection positioning slides by .010 - .015. To adjust, loosen screws and rotate the bail. Pull the auxiliary slides forward for checking the clearance.

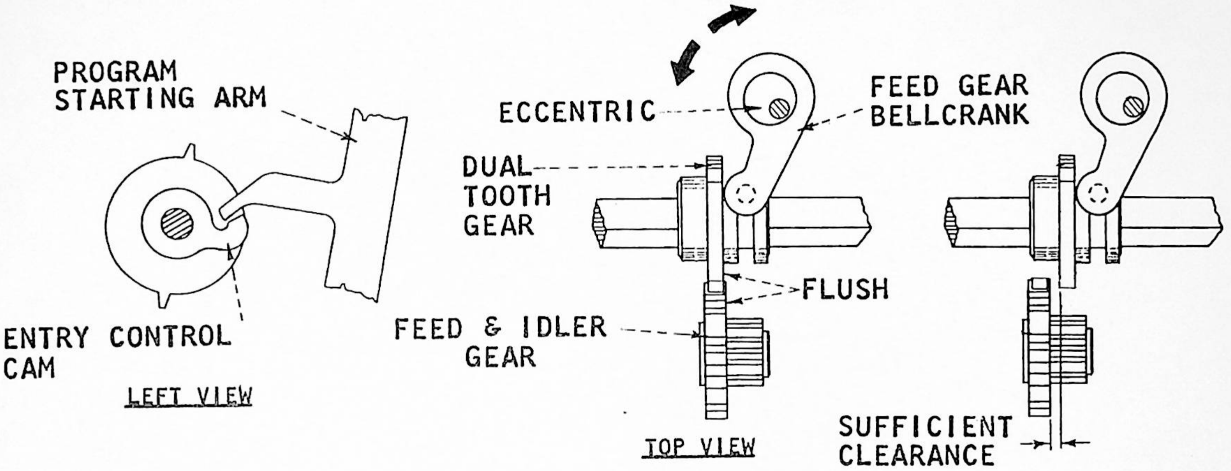




ADJ. 9C - TRANSFER BLOCK-ENGAGED POSITION: Keyboard out. Push the entry control gear from home position so the transfer blocks are raised into blocking position. Do not cycle the drive shaft. Adjust the transfer blocks for a minimum of .003 clearance to the selection positioning slides. This small clearance positions the right side (short) block to prevent excessive movement of the selection positioning slides during the transfer of the figures from the dials to the auxiliary slides, and also positions the left side (long) block to prevent the 1-5 selecting arms from positioning to more than a one selection. Too little clearance may cause the right side block to catch on the selection positioning slide when the transfer blocks swing upward into position.

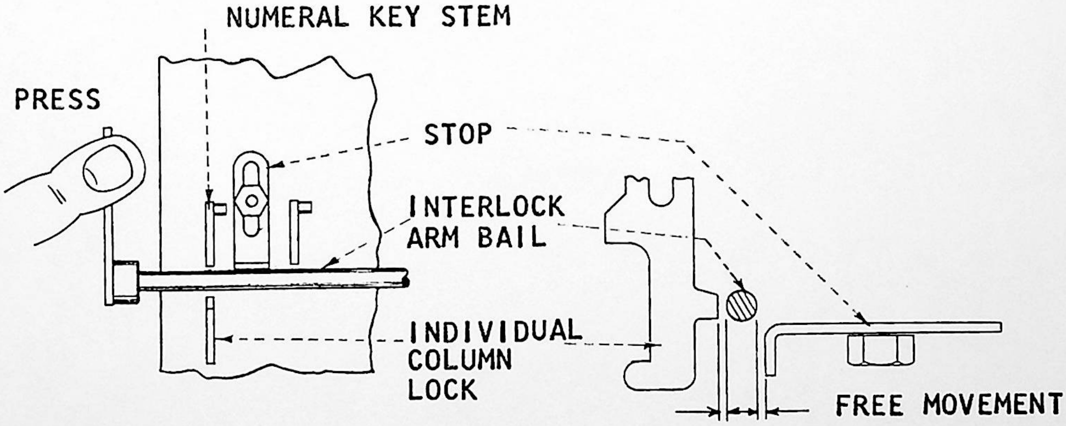


ADJ. 10A - RESTORE SHAFT: Carriage on and entry control cam in home position. Adjust the restore shaft link eccentric to obtain a minimum of .015 clearance between the back transfer fingers and the back transfer sensing fingers. This is to provide clearance during carriage shift. It is satisfactory if the clearance is not the same in all positions or equal on either end. After adjusting, manually rock the restore shaft to check for forward motion of back transfer fingers.

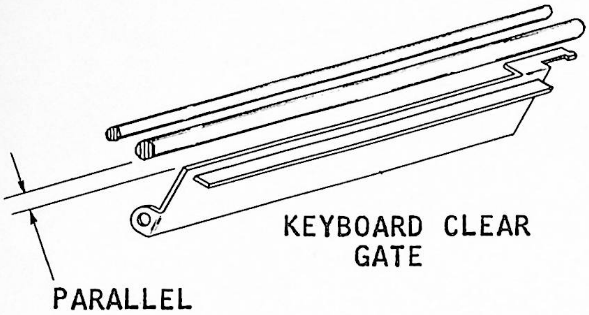


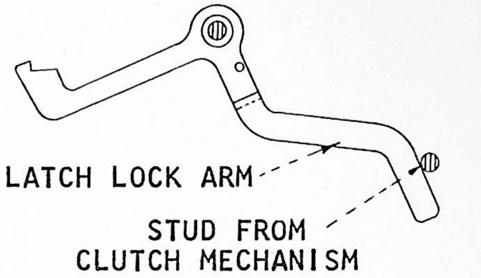
ADJ. 10B - DUAL TOOTH GEAR MESHING: Keyboard out, carriage on, 1's in 1st to 11th accumulator dials, 1st tab stop down. Depress starting shaft and cycle the drive shaft by hand until the entry control cam moves from home position and the dual tooth feed gears are in mesh with the feed and idler gears. Do not subtract the figures from the dials.

The right side of each dual tooth feed gear is to be flush with the right side of its feed and idler gear. The gears have side motion, so move the dual tooth gears to the right and the feed and idler gears to the left. Adjust each feed gear bellcrank eccentric. Keep eccentric up and to the left. After adjusting, cycle the drive shaft until all dials are at zero. The dual tooth feed gears have moved to the right of the feed and idler gears. There should be sufficient clearance between the gears to prevent the dual tooth feed gears from picking up a feed and idler gear during the remaining cycles of the machine in back transfer.



ADJ. 11 - INTERLOCK ARM BAIL STOP: Before installing the keyboard, adjust the stop to prevent the interlock arm bail from contacting the numeral keystems. Pull up on the individual column lock and check for movement of the interlock arm bail between the stop and the extension of the individual column lock.





ADJ. 12A - KEYBOARD INSTALLATION: Before installing, check for straightness of the keyboard clear gate. Align with the front shafts. Install the keyboard and have the latch lock arm to front of the stud from the clutch release mechanism.

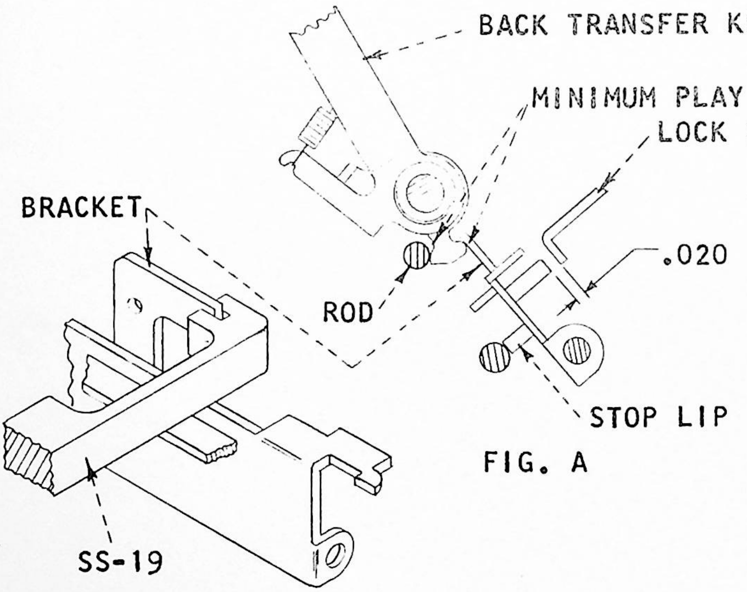


FIG. A

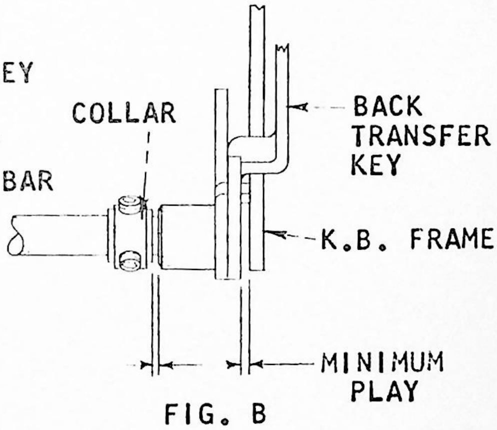
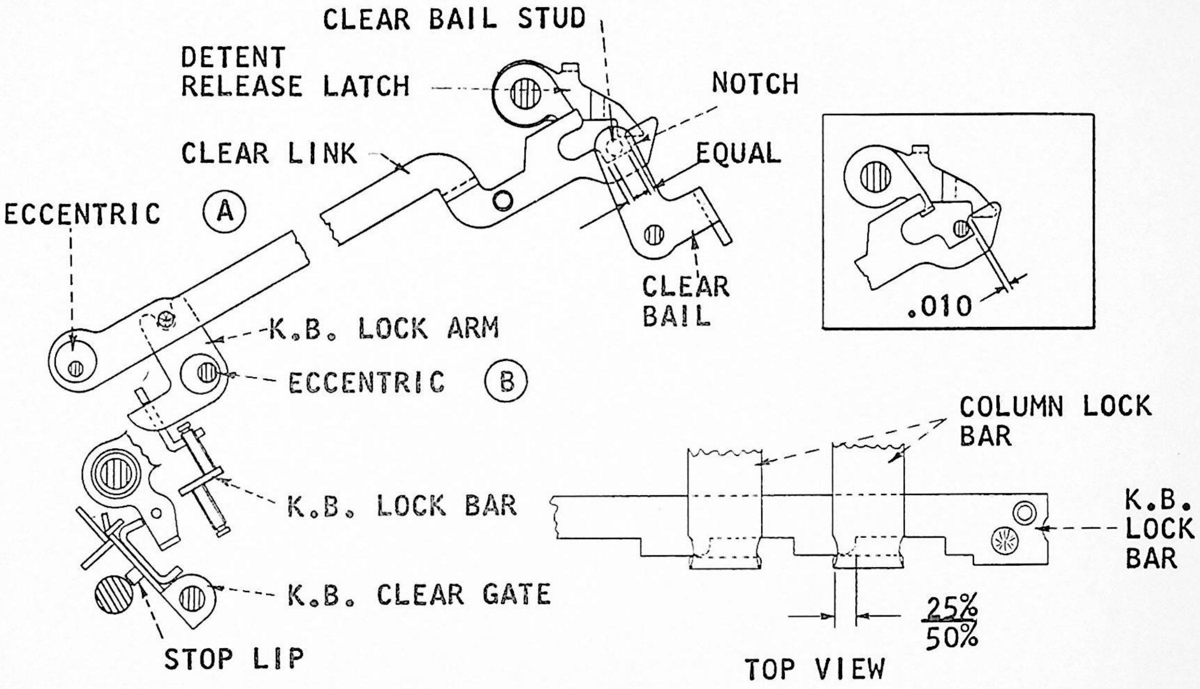


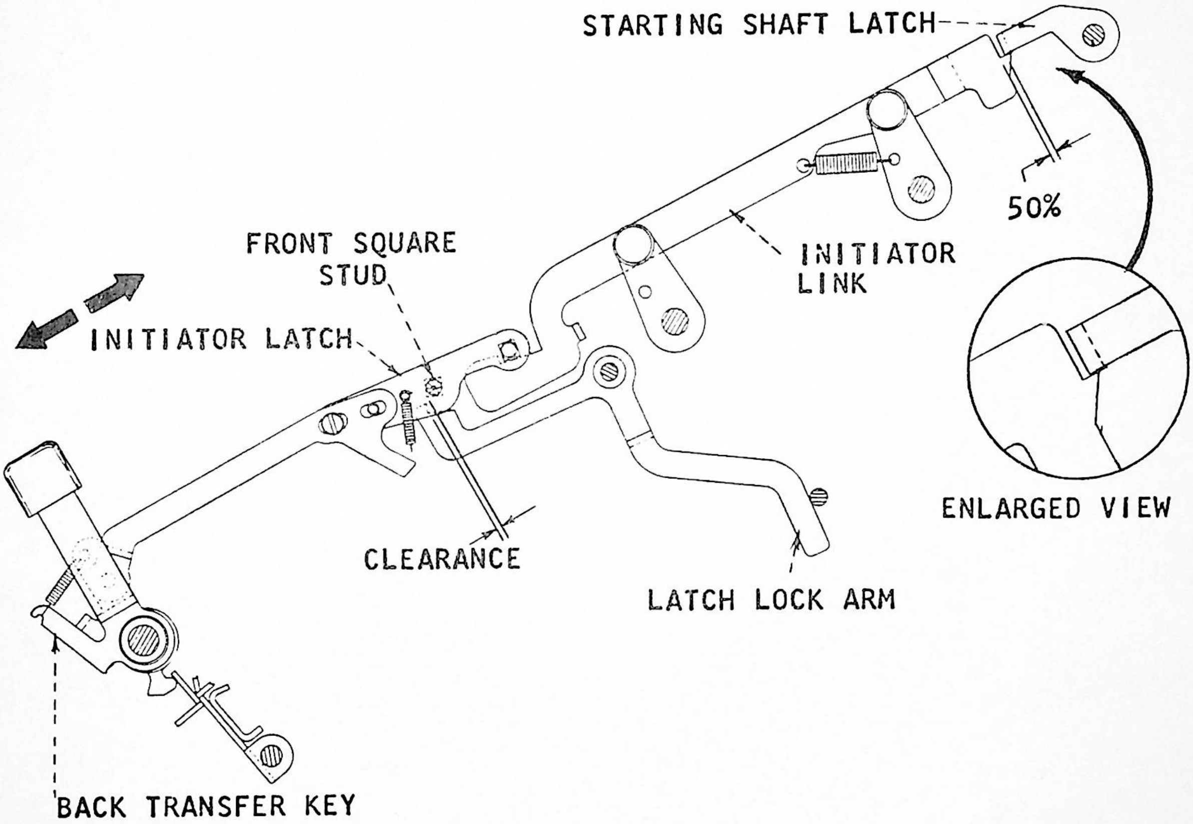
FIG. B

ADJ. 12B - KEYBOARD CLEAR GATE AND BACK TRANSFER KEY: The keyboard clear gate is to clear the column lock bars by .020 and the back transfer key is to have minimum play between the rod and the bracket and also minimum side play between the collar and the frame. (1) Obtain the .020 clearance by forming the stop lip, Fig A. If the lip is not contacting its shaft, check for the bracket limiting on the back transfer key. Move the collar and the back transfer key to the left. Form the bracket with SS-19. (2) After the .020 is obtained, move the back transfer key against the keyboard frame. Test for minimum play of key between the rod and the bracket. Form the bracket to remove the play. (3) Set the collar for minimum side play of the key between the collar and the keyboard frame, Fig. B.

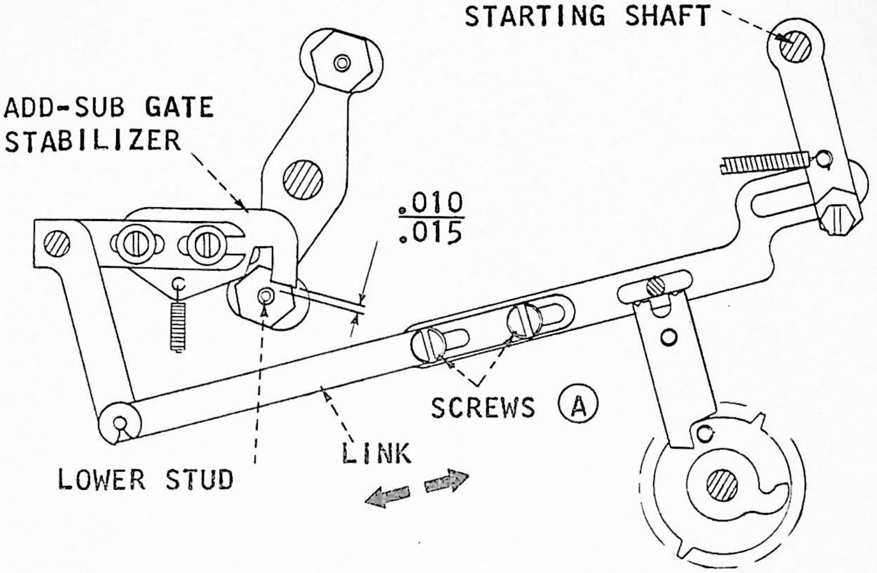
Test keyboard clearance. Depress all 1's. Depress keyboard clear key. All keys to clear. Depress 1's. Add Key down. Depress plus key and cycle drive shaft. All keys to clear with some overthrow of gate. The left side may clear late which is satisfactory if keys clear. The straightness of the gate, Adj. 12A is important.

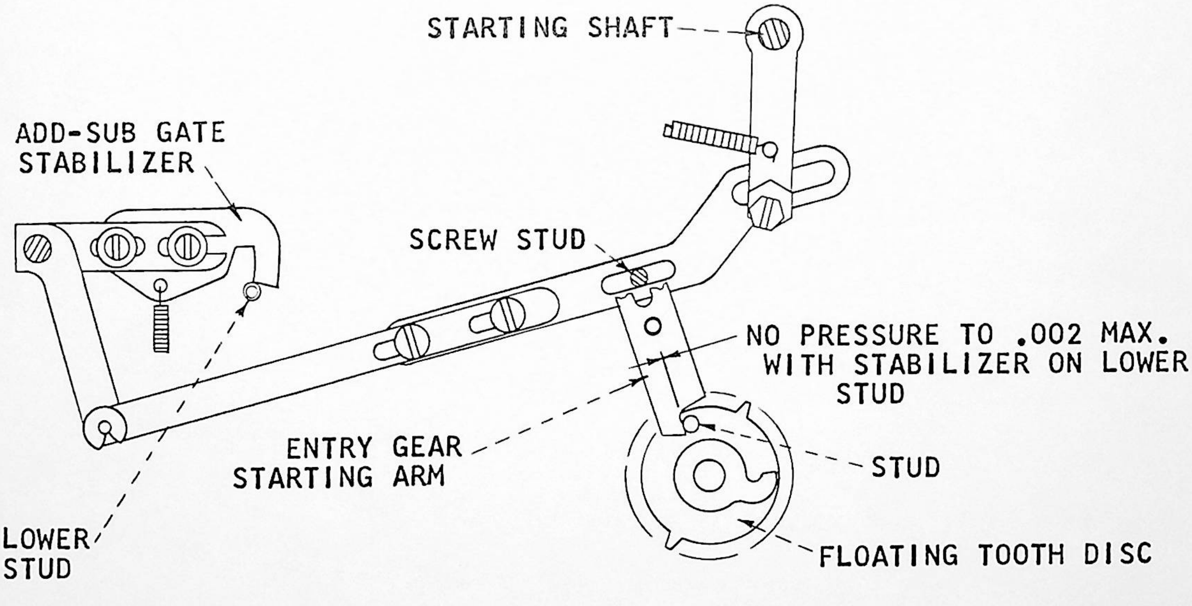


ADJ. 12C - CLEAR LINK AND KEYBOARD LOCK ARM: Raise the detent release latch to position the clear link rearward. (1) Adjust eccentric A for approximate equal clearance of the notch to the clear bail stud. Add key down, depress the plus key, cycle the drive shaft. The clear bail stud is to overtravel the detent release latch with at least .010 clearance (inset). When the keyboard clear link is at its maximum rearward travel, the clear bail is not to bottom with pressure. Eccentric A may need readjusting or if the end of the keyboard clear gate is formed, recheck Adj. 12A, 12B. (2) Raise the detent release latch. Adjust eccentric B so the keyboard lock bar has 25% to 50% of its maximum engagement behind the column lock bars.



ADJ. 12D - INITIATOR LATCH AND LATCH LOCK ARM: (1) Depress all 1's in the keyboard. Pull the back transfer key forward slowly. The keys are to release after the initiator link starts to move and all are to be released when the initiator link has approximately 50% engagement left to the surface of the starting shaft latch. Adjust the initiator latch. If the initiator latch is too far forward, there will not be enough clearance between the front square stud and the latch lock arm so the arm can raise when the clutch is released. (2) Depress the plus key; the latch lock arm is to raise and lock the initiator latch. When the drive shaft is in home position, the latch lock arm is to drop freely and be under the front stud. Form the latch lock arm if necessary.





ADJ. 13 - ADD-SUB GATE STABILIZER AND ENTRY GEAR STARTING ARM - HOME POSITION: Carriage off. Starting shaft latched in home position. (1) There is to be .010 - .015 clearance between the add-sub gate stabilizer and the lower stud. Adjust at screws A by sliding the link. (2) Trip the starting shaft so the stabilizer rests on the top of the lower stud. The entry gear starting arm is to have from no pressure to .002 clearance to the stud of the floating tooth disc. Adjust by sliding the screw stud. This is to insure the positioning of the floating tooth.

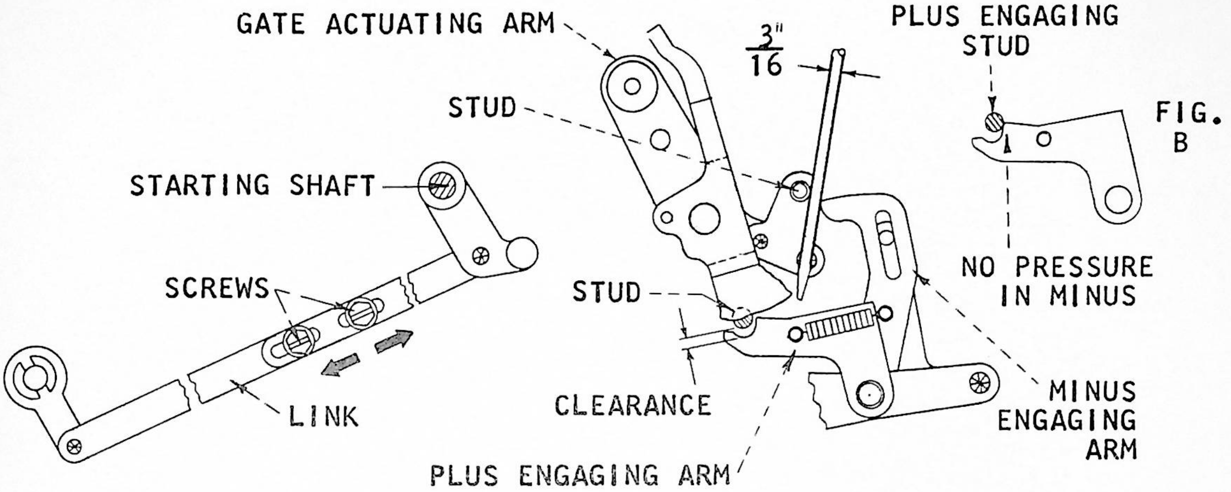
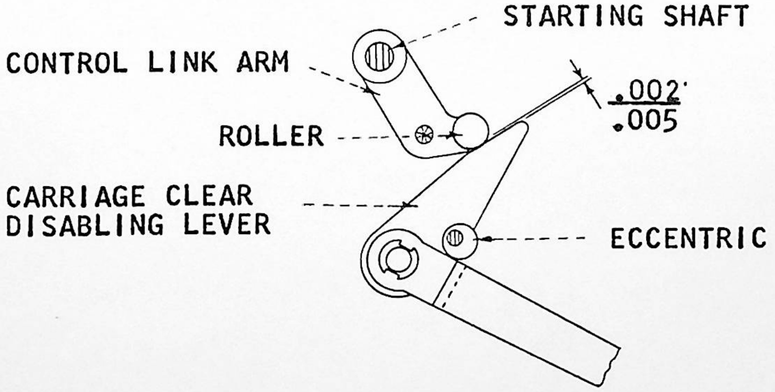


FIG. A

ADJ. 14 - MINUS & PLUS GATE ENGAGING ARM - HOME POSITION: (1) Have starting shaft latched. There is to be a minimum of 3/16 inch clearance, Fig A, between the minus engaging arm and the stud of the gate engaging arm. Use the shaft of screw driver SS-6 for gauge. Adjust by sliding the link. The plus engaging arm will have clearance to its stud. (2) Fig. B. Depress minus key and cycle the drive shaft so the gate is in minus. Adjust the plus engaging stud without pressure to the plus engaging arm. This positions the stud so the gate will be positioned fully in plus position when machine is operated in standard tabulation.



ADJ. 15 - CARRIAGE CLEAR DISABLING LEVER- HOME POSITION: When the starting shaft is latched in home position, there is to be .002 - .005 clearance between the roller of the control link arm and the carriage clear disabling lever. Adjust at the eccentric.

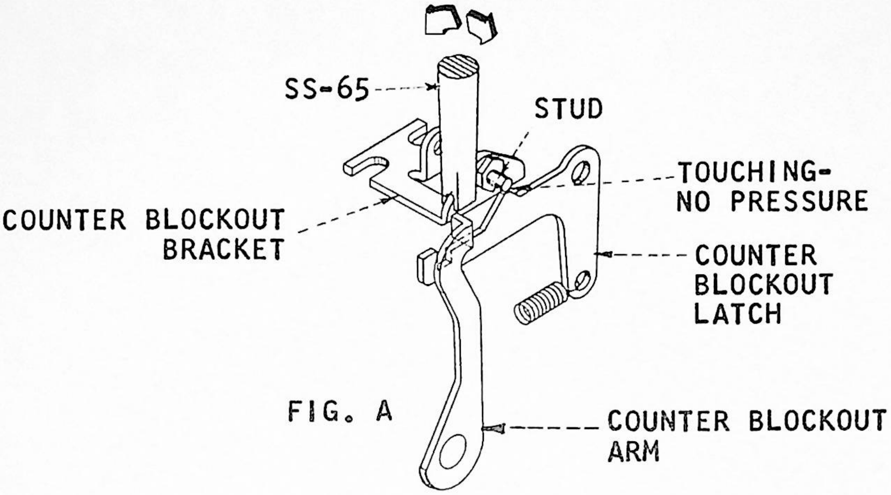


FIG. A

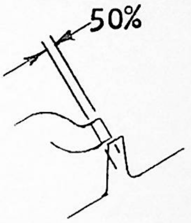


FIG. C

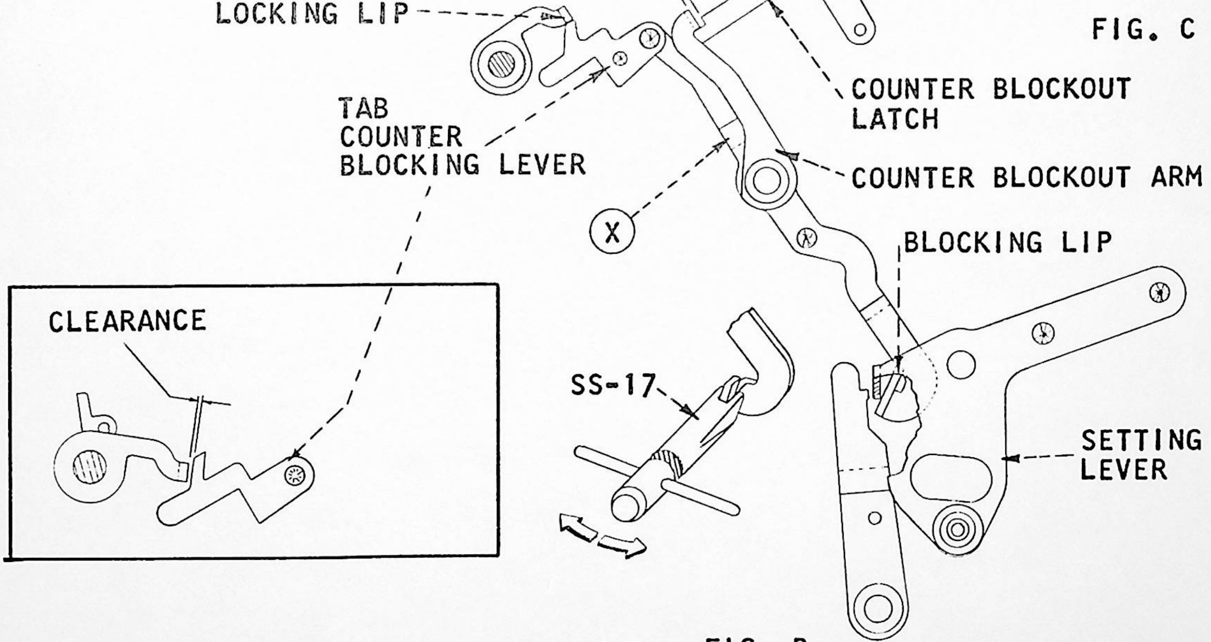
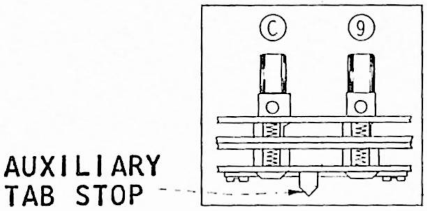


FIG. B

ADJ. 16 - COUNTER BLOCKOUT: (1) Fig A. When the gate is in home position, the counter blockout bracket is to touch the counter blockout latch with no pressure. Form the counter blockout bracket with SS-65. This is to insure the delatching of the counter blockout arm when the gate centralizes. (2) Fig B. Power off, trip the setting lever to position the gate in plus. The counter blockout arm is to latch in the counter blockout latch with overlatch. Form the blocking lip. (3) Fig C. Rotate the hand crank enough to restore the setting lever, leaving the counter blockout arm latched. The tab counter blocking lever is to be under the locking lip at least 50%. If not, form at X, Fig B. (4) Cycle the machine in a plus operation. The locking lip is to dip without contacting the tab counter blocking lever, inset.



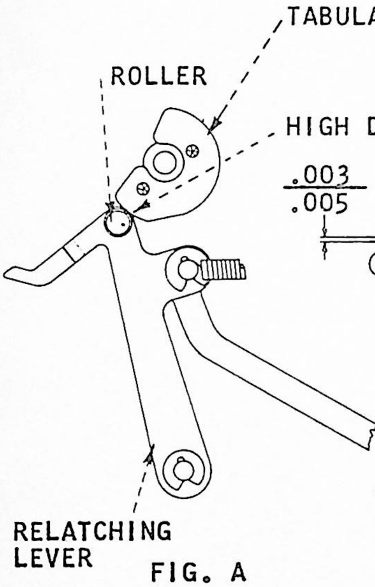


FIG. A

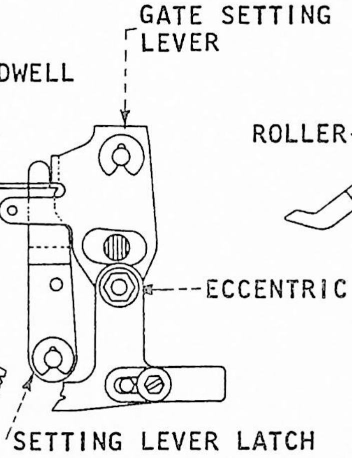


FIG. B

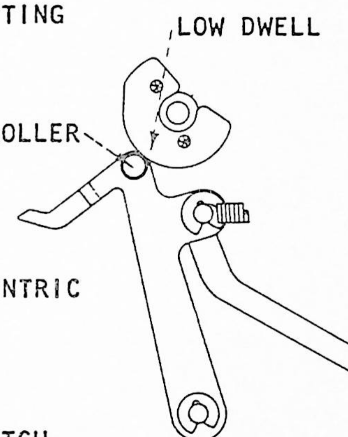


FIG. C

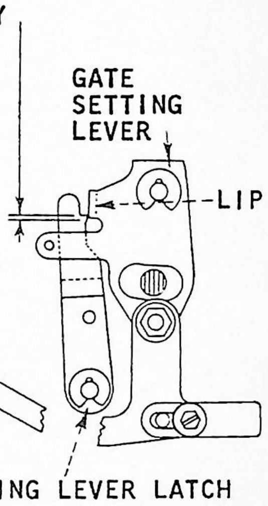
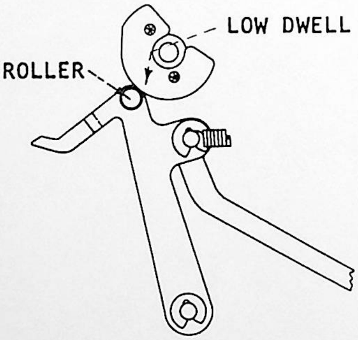
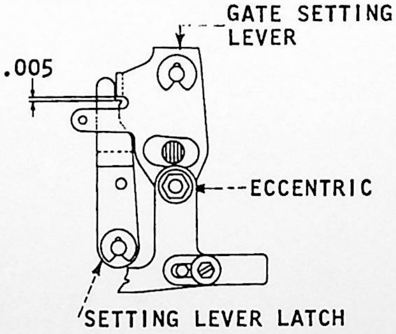
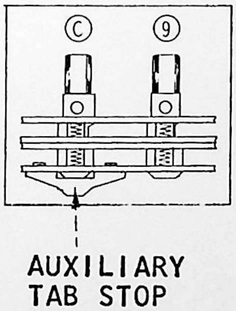


FIG. D

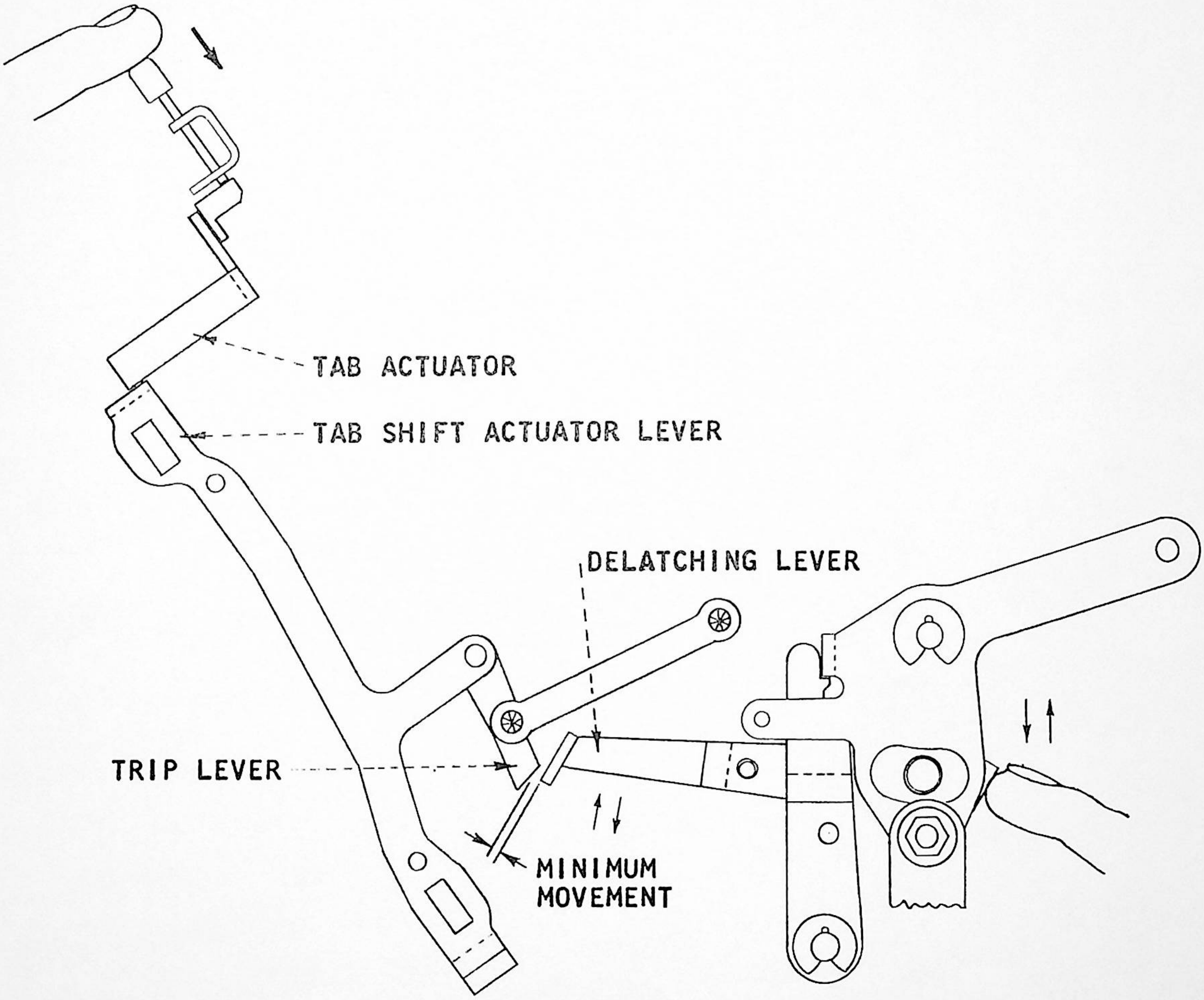
ADJ. 17 - RELATCHING GATE SETTING LEVER: Early models had the auxiliary tab stop located between the C and 9 tab stop, inset. When the roller of the relatching lever is positioned on the tabulating restore cam high dwell, Fig. A, adjust the eccentric for .003 - .005 overlatch of the gate setting lever to the setting lever latch, Fig. B. When the roller is on the low dwell of the cam, Fig. C, manually trip the setting lever latch. The gate setting lever lip is to drop a few thousands of an inch behind the setting lever latch, Fig. D. This is necessary to insure the tripping of the gate setting lever when the carriage tabulates to the extreme right with no tab stop depressed.



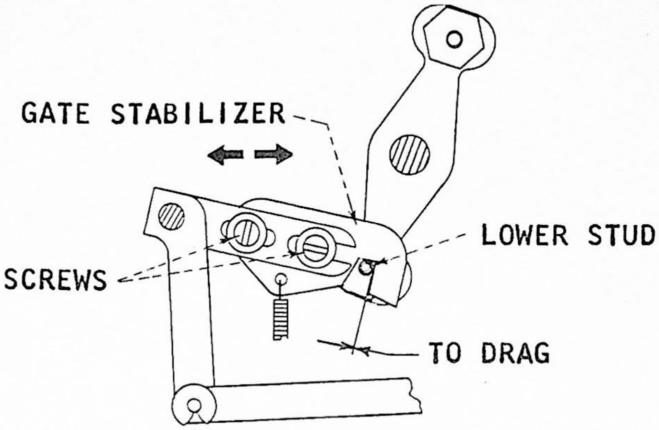




ADJ. 18 - RELATCHING GATE SETTING LEVER: Machines having the auxiliary tab stop located to the front of the C tab stop, inset, are adjusted different than in Adj. 17. When the roller is on the low dwell of the restore cam, adjust the eccentric to give approximately .005 overlatch between the gate setting lever and the setting lever latch.



ADJ. 19 -DELATCHING LEVER TO TRIP LEVER: Carriage in first position. The standard adjustment between the tab actuator and the tab shift actuating lever is to be correct. Depress and hold the 0 tab stop. There should be a minimum of movement between the delatching lever and the trip lever, when the delatching lever is manually moved. Adjust the delatching lever. The ends of the delatching lever and trip lever are different on the SBT to allow tabulation in the first carriage position. If the parts are too close, a sharp depression of the tab stop could trip the mechanism.



ADJ. 20 - ADD-SUBTRACT GATE STABILIZER - ENGAGED POSITION: Carriage off. Power off. Pull back transfer key. Manually trip the tab gate setting lever to position the gate in the minus position. The stabilizer is to drag on the lower stud as it drops. Loosen the screws and slide the stabilizer. The drag is to prevent the gate from bouncing during the back transfer cycles. Rotate the drive shaft and test.

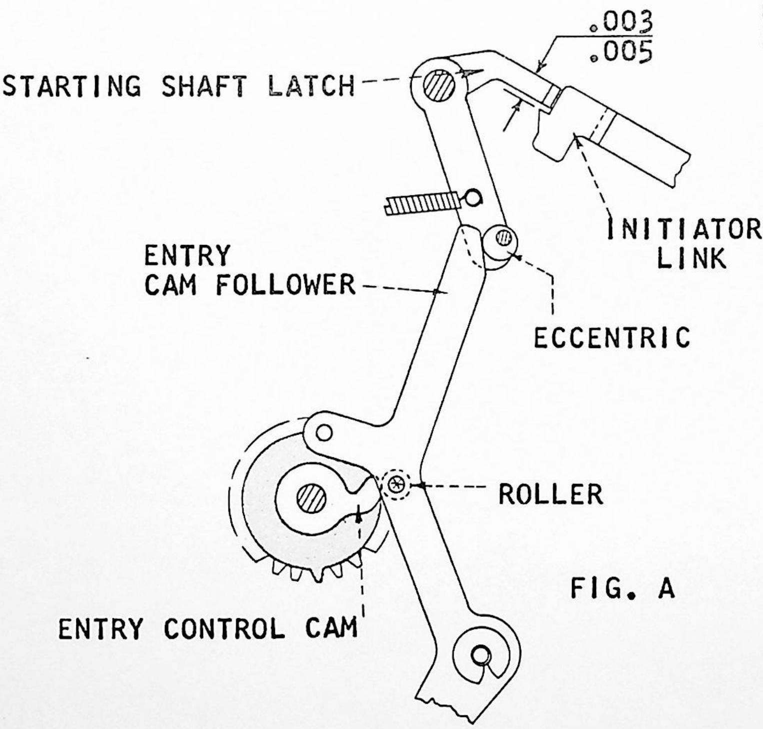


FIG. A

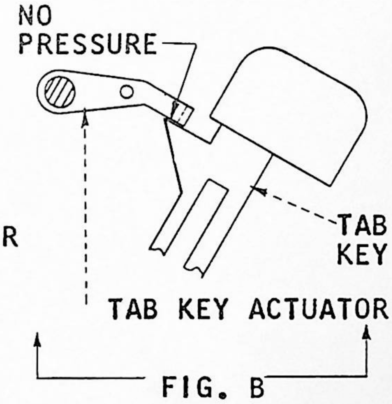
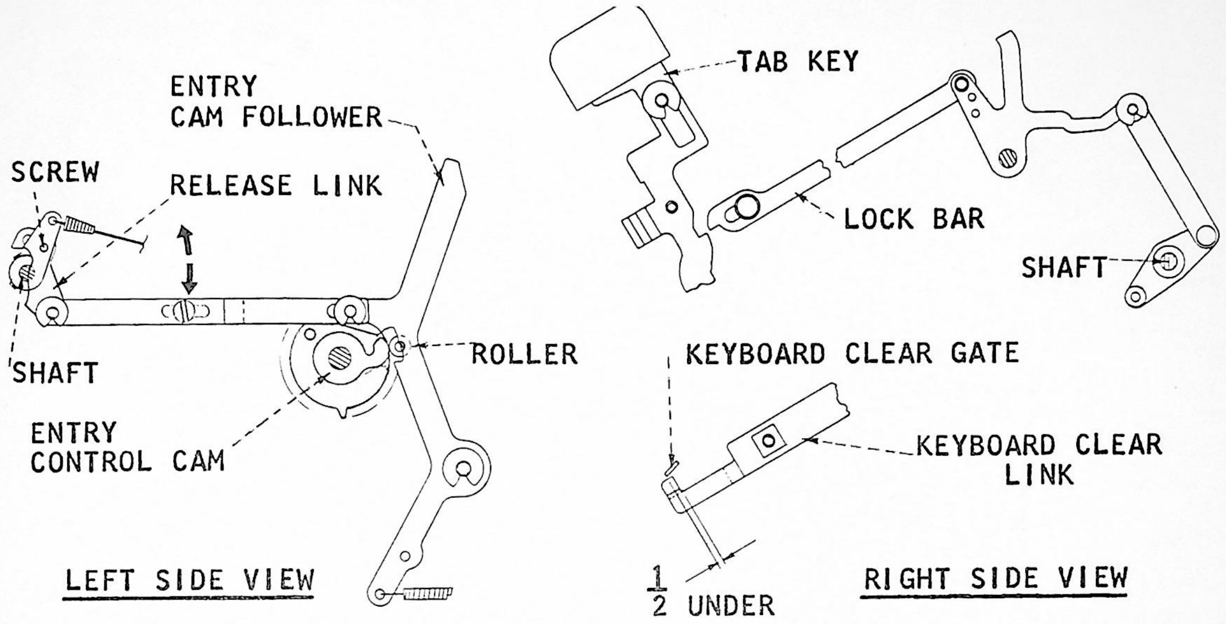


FIG. B

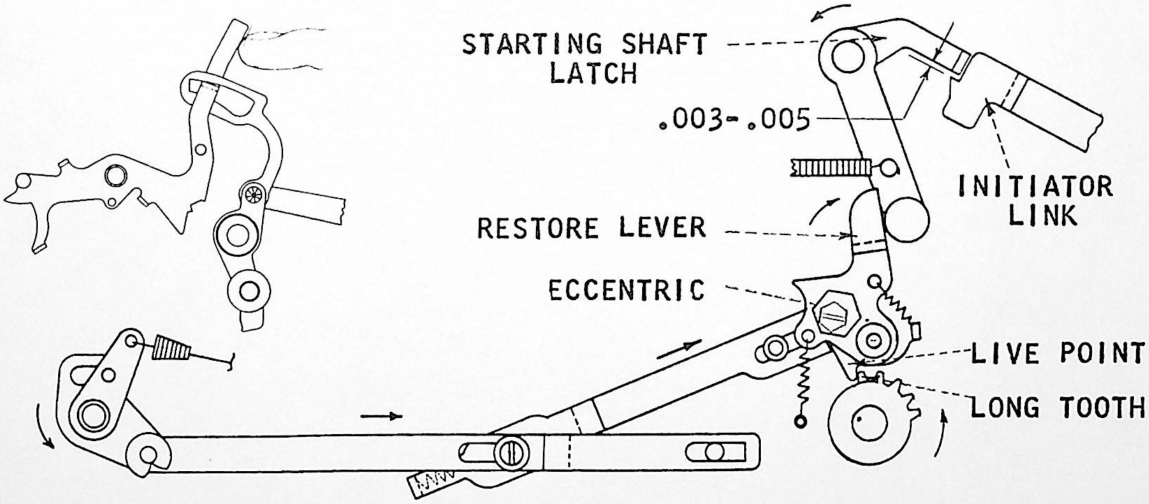
ADJ. 21 - STARTING SHAFT RELATCHING: Carriage on. 1st tab stop set. Operate machine in back transfer by hand crank until the roller is on the high point of the entry control cam. (1) Adjust the eccentric for .003 - .005 overlatch of the starting shaft latch to the initiator link. (2) Crank the machine to home position. When the starting shaft latch is latched onto the initiator link, the tab key actuator is not to press on the tab key. Excessive clearance may cause failure of key latching.



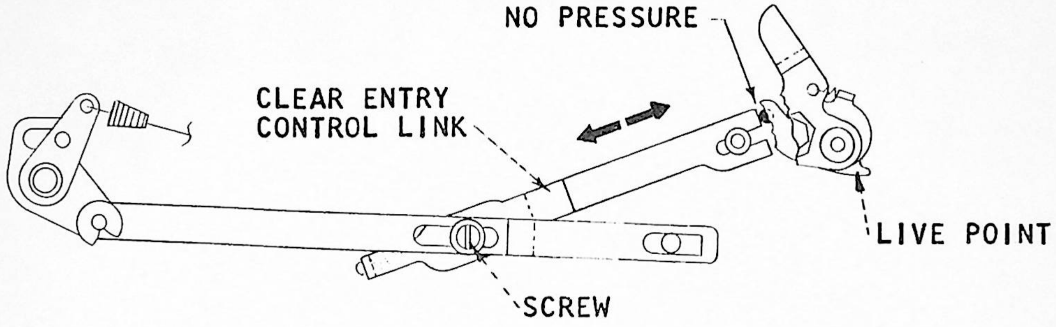
LEFT SIDE VIEW

RIGHT SIDE VIEW

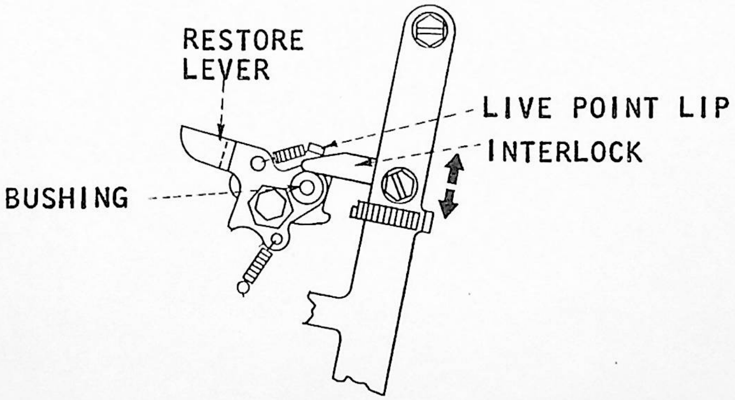
ADJ. 22 - ENTER DIVIDEND KEY RELEASING: Have the add key forward, a tab stop down, and machine in back transfer. Rotate the drive shaft by hand crank until the roller of the entry cam follower is riding up the entry control cam. The enter dividend key is to release when the keyboard clear link is on its last rearward movement and is approximately 1/2 of its movement under the lip of the clear gate. Adjust by loosening the screw on the release link and rotating the shaft. This is to keep the keyboard from clearing at the termination of back transfer. Do not change the set screw setting of the release wire.



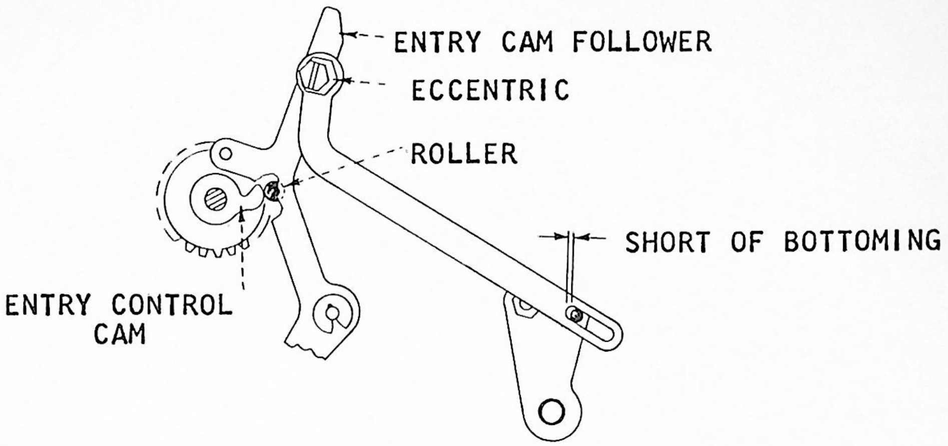
ADJ. 23A - RELATCHING OF STARTING SHAFT FROM DIVISION STOP KEY: Manually engage the live point and cycle the drive shaft until the long tooth picks up the live point. Rotate the drive shaft slowly. The long tooth is to retain its engagement with the live point until the starting shaft latch has overlatched the initiator link by .003 - .005. Adjust at the eccentric, keeping it up. Test relatching by pushing to the rear on the division stop key and cycling the drive shaft.



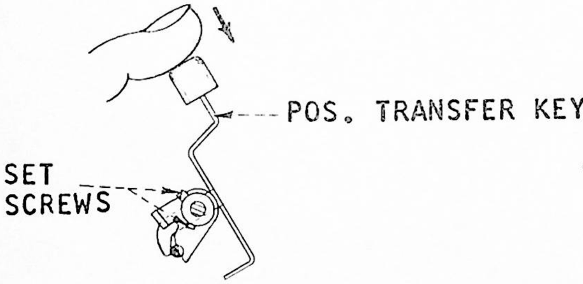
ADJ. 23B - CLEAR ENTRY CONTROL LINK: Machine in home position. Loosen the screw and adjust the clear entry control link up to but not touching the stud on the live point.

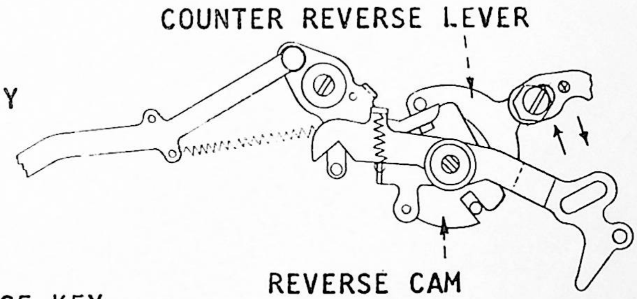


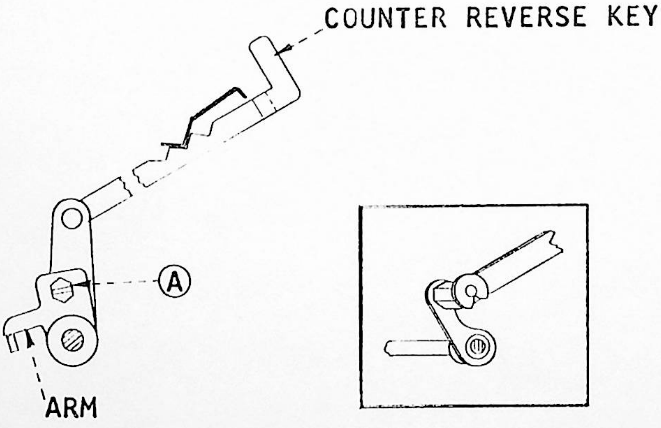
ADJ. 23C - RESTORE LEVER BLOCKOUT: Have the machine tripped and cycled in a back transfer operation. Adjust the interlock to position between the live point lip and the bushing. When the interlock is adjusted, the live point should not contact the back transfer program gear when the division stop lever is pushed to the rear.

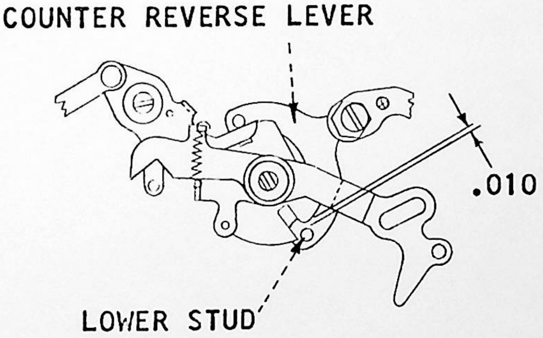


ADJ. 24 - MULT KEYS RESTORE LINK: Cycle the machine in back transfer until the roller of the entry cam follower is on the high point of the entry control cam. Adjust the eccentric so the mult keys restore link is just short of bottoming on the stud of the clutch opening lever.

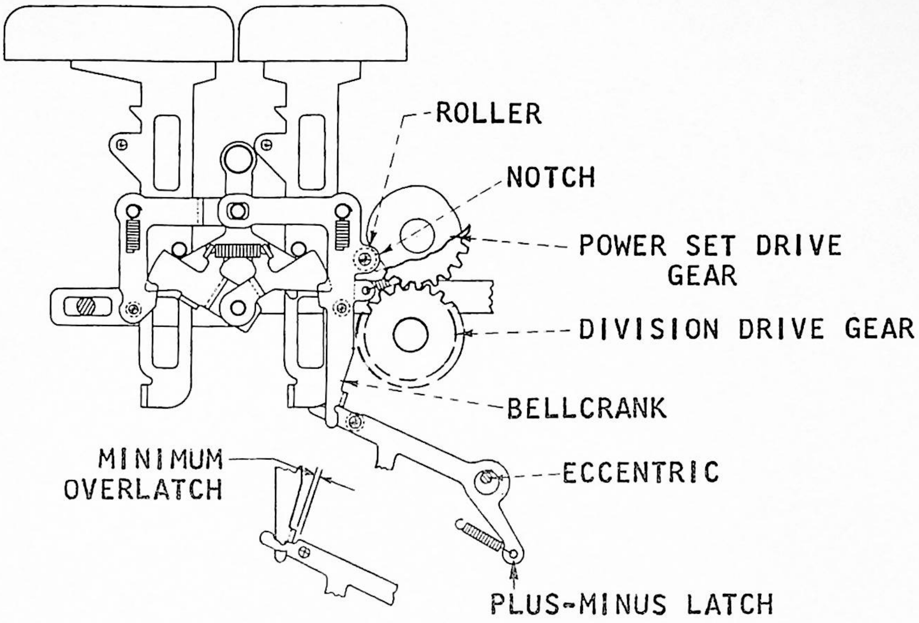




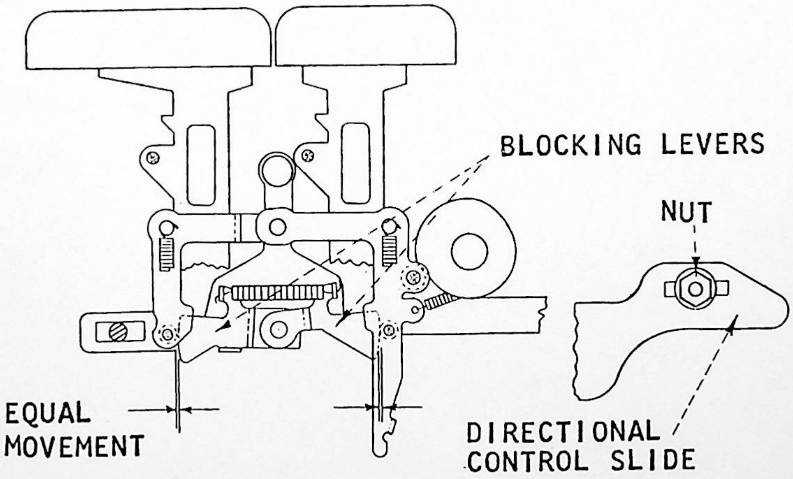




ADJ. 25 - COUNTER CONTROL: (1) Hold down the positive transfer key. Loosen the set screws and rotate the shaft so the counter reverse lever is held in the up position and has some movement between it and the reverse cam. Tighten screws. (2) Counter reverse key in the gradient position. Loosen screw A and slide the arm to position the lower stud with approximately .010 clearance as shown. Move the reverse lever to rear to test. The clearance positions the lower stud so it will cam into the slot on gradient operation. (Do not adjust the eccentric, inset.)



ADJ. 26A - PLUS-MINUS POWER SET: (1) Timing. When the drive shaft is in home position; the power set drive gear is to be timed with the division drive gear so the roller of the bellcrank fits into the notch of the drive cam. In this position, the roller is immediately picked up on the first motion of the drive cam. (2) Run the machine under power with the plus key held down. The gate should not flicker. Adjust the eccentric of the plus - minus latch to control the overlatch to a minimum between the bellcrank and the plus - minus latch.



ADJ. 26B - GATE ENGAGING - POWER SET: Manually depress the blocking levers. Loosen the nut and position the directional control slide so there is equal movement between the blocking levers and their rollers. Tighten nut. This gives the setting for the add-sub gear mesh in plus or minus operation.